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The Diesel Motor and Motor Vessel

Of all advancements in the mechanical world during the twentieth century, probably one of the most efficient machines now being perfected is the Diesel engine.

The Diesel motor is a mechanism capable of burning the very low grades of fuel oils with perfect results. The fuel is very cheap, and only a minimum quantity is necessary for the engine's consumption.

The principle of the engine does not resemble the ordinary gas or steam engine in the idea of internal combustion.

The motor is constructed in several types ranging from one cylinder up to eight, the latter developing over 2,000 horsepower.

The principle of the power impulse of the motor is as follows: On the upstroke of the piston pure air is compressed in the working cylinder to a high pressure, and thereby becomes heated above the flash point of the fuel oil. Shortly before the end of the up stroke fuel oil is injected under a very high pressure. The oil starts to burn immediately, and combustion under steady pressure takes place at first, and then the products of combustion worked by steady expansion. At the end of the stroke the burnt gases are exhausted through ports uncovered by the piston, and by certain novel arrangements provided, the cylinders are scavenged and filled with pure air, which is then compressed and the cycle repeated.

Several distinctive companies have undertaken the construction of the Diesel engine. Among others are the Sulzer Diesel and the more modern Reiherstieg motor. The former has been in actual service, but the latter as yet has only been tried in the shops. The building of a new ship has delayed its installation for actual service.

The Sulzer Diesel was installed in the new ship Monte Penedo. So far her services have proved satisfactory, although we must admit there is a large gap to be bridged before the typical shipowner will be satisfied.

The Monte Penedo measures 350 feet in length, 50 feet in breadth, and 27 feet in depth. She has a gross registered tonnage of 4,000 ,and can carry 6,500 tons of cargo. She is built according to the most modern methods of construction of seagoing vessels. She has a double bottom for ballast, and not for fuel, as in the case of steamers. Her engine room takes up only 53 feet of her hull. Her engines and engine accessories total 160 tons.

A considerable gain has been achieved in the cargo-carrying capacity in comparison with a steamer of the same power and dimensions. A triple expansion engine, boilers and auxiliaries, 2,000 horsepower for the Monte Penedo would have figured about 410 tons, showing a Diesel equipment to have saved 250 tons in the engine room.

THE DIESEL ENGINE

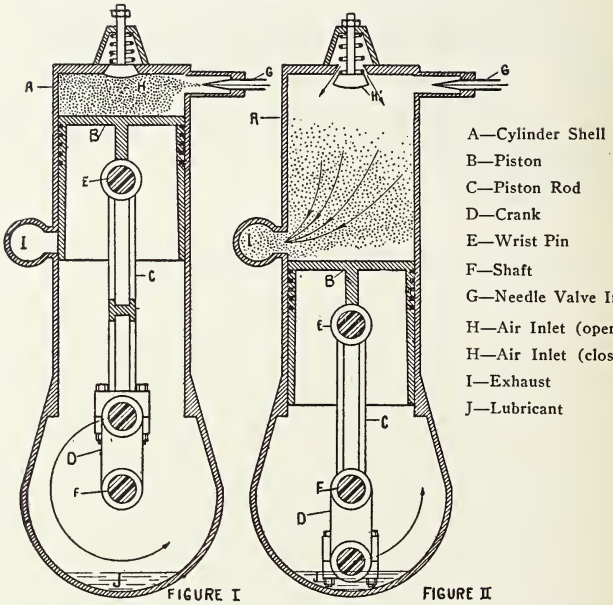


Fig. I—Compression. **Fig. II—Burnt Gases Exhausting.**

The Sulzer engines have shown a consumption of 0.37 pounds of fuel per one horsepower hour. The triple expansion engine consumes 1.55 pounds of coal per one horsepower hour. The Sulzer engines use approximately 210 tons of fuel on a voyage between Hamburg and Buenos Ayres, which is the chartered route of the Monte Penedo. For the same voyage 700 tons of coal would be consumed by the steam engine. Of course no ship could cut her bunkers so fine as the consumption foreseen, so it would be more correct to calculate the bunkerage 50 per cent in excess.

Since the fuel consumption is so small on the Monte Penedo it is only necessary to charge her bunkers at the home port. Her total bunkerage is 628 tons, less than half the amount a similar steam vessel would carry. Her small bunkers increase her carrying capacity approximately 775 tons extra.

Only six greasers and firemen are necessary in the Monte Penedo's engine room, while on a similar vessel equipped with steam, sixteen firemen and engineers are necessary. From its good advantages the Monte Penedo can earn nearly $9,000 more than an equivalent steamer by freights on a round trip.

The advantages by far overbalance the disadvantages of the motor. It is cumbersome, complicated and delicate about running; still its good points are fast covering its faults, and in a few years the mechanism will become nearly perfect from all criticism, and as widely used and exploited as the present internal combustion types.

N. Nelsen, '15.

Color Photography

PRACTICAL color photography might well be termed three-color photography, for the three-color process in one of its modifications is the only method outside of M. Lumieres' theory now in use. This three-color process is what might be termed a descendant of orthocromatic photography.

Before a plate emulsion could be made sensitive to red, which is very essential to any color process, M. du Hauron published a method by which, iwth such sensitiveness a three-color process might be given to the photographic world.

According to the Young-Hemholtz theory, there are three *somethings* in the eye of every one, not color blind, which are affected by red, green, and blue-violet respectively. So, when one looks at a pure blue-violet object, the blue *something* in the eye is affected and the others are not; or, when we see a yellow object it excites the red and green *somethings* or sensations in the eye, and the combinations of these two gives us the sensation we call yellow. If any colored object could be analyzed to find to what extent the three different sensations of the eye are excited, and then three pigments found, each one of which excited only one of the sensations in the eye, then upon mixing these pigments in the same proportion as in the original object, the color of the mixture would be the same as the color of the object. M. du Hauron attempted to use this theory in his work.

Three-color photography requires that three different negatives of the view be taken. These are exposed through color filters, through which can pass only the rays to which the plate being exposed is sensitive. For instance, a picture is taken with red and green in it; the filter, used with the plate sensitive to red, allows only the red rays to pass through. With different colored filters the action is the same on the other plates. When developed, these three plates have no color in themselves, but are only records of the extent to which the subject excited the three different color plates in the camera.

These negatives are then printed in colors. The object of each color is to excite the primary color sensation in the eye exactly as that sensation would have been excited by the original object. These plates are usually printed by a modification of the carbon process, in which, by the use of dye solutions, all three pictures may be made on one or three sheets of transfer paper. Another way to print them is to multiple print them in gum, and, in this manner many weird effects have been achieved.

M. Lumieré's theory is the one now in use for colored glass transparencies. It is very simple, it being almost as easy to get a color transparency on a color plate as it is to make a black and white negative. The plate is called the "autochrome" or screen plate. It is a remarkable step forward, but the three-color process is also used, as with it a print in colors is the final result, while with the "autochrome" a colored transparency is the final result. So, when a paper emulsion is discovered and prints from screen plates are possible, it will be as easy, although more expensive, to get color prints as it is to get black and white prints now.

The method by which the "autochrome" or any other screen plate accomplishes its object is not new, the method of the manufacture of a screen plate having been published some years ago. No one but the Brothers Lumiere seemed to realize its possibilities. In the summer of 1907, the first screen plates were put on sale. It was then that the photographic world awoke to the full

importance of the work accomplished; 1907 means to the art of color photography what 1740 means to the novelist.

The work accomplished is this: A plate is made commercially and is exposed in the camera, a suitable yellow screen being on the lens. A development similar to the development of ordinary plates, and the result will be a color transparency with the colors of the original object reproduced to the minutest detail of color. No three-color process yet used has been able to rival the "autochrome" in color rendering. The finest shades, the most subtle of tints, are reproduced as faithfully as the crudest of primary colors. These plates will also stand the greatest test of all; namely, they will render black, white, and gray without the slightest trace of color. These plates do not need any delicate adjustments of screens or dyes on the part of the photographer. It is all in the plate. The photographer has only to expose and develop the plate and he will have a colored transparency as a result.

The way the work is accomplished is in this manner: The material employed is potato starch. It is a well-known fact that starch granules, when obtained from the same source, are the same shape, and to a very large extent the same size. With potato starch granules the shape is almost circular, and they are approximately one two-thousandth of an inch in circumference. Three separate portions of these granules are dyed with correct dyes, red, green, and blue violet respectively. These three powders are then mixed in such proportions that the resulting powder has no basic color. That is, the three colors are so mingled that, to the eye, they are a neutral gray tint. A glass plate is then coated with a suitable adhesive and the powder is dusted over it in a single layer, no two granules overlapping. How this is done is a trade secret As these granules are round, there are small spaces at the "corners" where light could get through, and as these spaces must be filled the plate is put under great pressure, by which the grains of starch are flattened out. This pressure is applied until the plate is covered by one entire layer of granules without any spaces between them. Seen through a microscope the plate looks like a stained glass window. Seen by the naked eye, the color is a pure olive gray. The screen part of the plate is now finished.

The making of the screen part of the plate is not strictly a photographic process, and, therefore, is able to be made in any desired light. The photographic side now commences. The coated plate is now treated like an ordinary panchromatic plate except that the emulsion must be exceedingly thin and very fine in its grain. When the plate has been coated with the emulsion it is ready to be put on the market as the "autochrome" plate.

The simplicity of its use also makes it desirable. It is exposed in the camera with the glass side of the plate toward the lens, so that the light has to pass through the starch grain layer before it touches the sensitive coating. A special yellow color screen is also necessary to counteract the inevitable sensitiveness of a photographic emulsion to blue and violet rays. The exposure can be calculated in the usual manner with exposure meters, the rapidity of the plate being about Watkins 2, or Wynne F/14. After exposure, the plate is developed by time in a pyro-ammonia developer, and instead of being fixed in Hypo is immersed in a solution of potassium permanganate acidified by sulphuric acid. This dissolves out the silver negative image, which has been developed by the pyro-ammonia, leaving a positive image in silver bromide as a result. This bromide image in its turn is converted into a silver one by being treated with an amidol developer, in any desired light, and the positive image so obtained, after being intensified, is the final result—a colored picture on glass.

The action taking place is as follows: Take, for instance, an object of a bright yellow color. The yellow rays entering the lens fall upon the starch layer, through which they have to pass to reach the sensitive emulsion. The

yellow light is freely transmitted by the grains of red and green color, but is stopped completely by those of the violet hue. The result on development is, that on the part of the plate where the image of the yellow object fell, behind every little particle of red and green starch, a little black speck of silver shows up. But behind the violet particles no image can be developed, as the violet has stopped the yellow light. These little developed specks block up the red and green particles so that if we fixed the plate at that stage of development the bright yellow object would be represented by violet, as the violet particles have no developed image blocking them up; in other words, we would have a negative image, one in which not only the light and shade, but the very colors themselves are reversed, violet being the complementary of yellow. If the plate were stopped at this stage it would be interesting to note how faithfully every color is represented by its complementary color.

The plate, after development, is put into the acidified permanganate, which dissolves out the image just developed. Accordingly, behind the red and green particles there is no longer an obscuring particle of silver after this treatment, and therefore they transmit the light freely. But as the plate has never been fixed, there is a semi-opaque particle of unaltered silver bromide partly obscuring the violet particles. After this treatment the yellow object is represented by a mixture of red and green, with a little violet, as the silver bromide is not quite opaque. The combined effect of red, green and violet is white, and the combined effect of red and green on the eye is yellow; so that, at this stage, the yellow object appears yellow, but weakened by a certain amount of white. By treating the plate with developer again, the silver bromide, that partly obscures the violet, is turned into metallic silver, which obscures the particles of violet more effectively, and this obscuring is completed by the intensification process. The yellow object is now seen in its true color, and in the same way ,all the complex shades of a natural subject are faithfully reproduced.

This is all that is at the present time possible. But it is expected that the near future will bring more important discoveries in the line of color photography.

O. P. Jungblut, '15.

The Transmission of Photographs

By Wireless Telegraphy

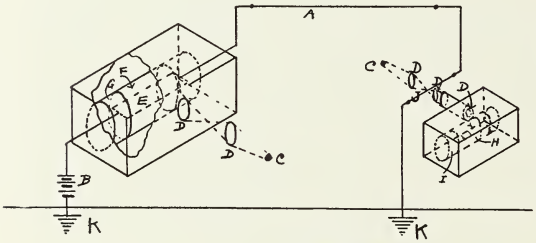
AS almost every one now knows, the transmission of photographs by medium of wires is an accomplished fact. The person to whom most of the credit for this invention is due is Professor Korn of Charlottenburg. He has been experimenting with photo-telegraphy, as it is called, for many years, and at last his apparatus has passed from the experimental into the commercial stage. There are photo-telegraph stations in many of the larger cities on the continent—in London, Paris, Berlin and Monte Carlo, for example.

A new stage of the development of this art, which, however, is not generally known, is the transmission of pictures and photographs by radio, or wireless telegraphy. This is called "radio-photo-telegraphy," for it is a combination of the three.

Before taking up the details of radio-photo-telegraphy we first should review Professor Korn's wire system. The sending equipment consists of a light-tight box, within which is a transparent cylinder. Inside of this cylinder a sensitive selenium cell is placed. Upon the outside of the cylinder, which is usually of glass, the picture to be transmitted is wound. This is in the form of

a common photographic film, with its lights and shades. In one side of the box a lens is mounted, which, as the cylinder revolves, moves gradually from one end of the cylinder to the other—very much in the same way that the needle of a talking machine moves. A source of light, usually a Nernst lamp, is placed so as to cause a single ray of light to fall on the lens. This light passes thru the film onto the selenium cell. If the light is stopped by a dark place on the film the resistance of the selenium cell rises, the rise in resistance depending on the intensity of the light. All these changes in resistance cause corresponding changes in the current going over the line to the receiving station, and thus, as the cylinder revolves, the whole picture is gradually exposed.

The receiving station, which is to change these electrical impulses back again to a recognizable picture, has a very similar action to the sending station, but, of course, in reverse order. There is a corresponding light-tight box contain-

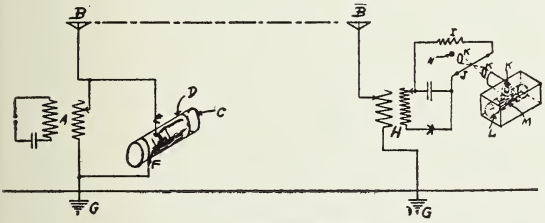


Wire System

ing a rotating cylinder, the moving lens, and the Nernst lamp; besides these, however, there is a very sensitive "string" galvanometer. This instrument consists of a very powerful electro magnet, the poles of which are brought very near together as in a horseshoe magnet, except the poles are much closer. A very fine "string," or fibre, usually of silver-plated quartz, altho sometimes only of fine wire, is suspended in this enormously powerful magnetic field. The slightest current flowing thru this fibre causes some slight motion in it, owing to the attraction or repulsion due to the magnetic field set up around the fibre by this current. A tiny beam of light is arranged so as to be controlled by the fibre. When the fibre is at rest the light is shut off, any slight motion allowing some or all of the light to pass on its way; the greater this motion the greater the light, until full brilliancy is reached. Lenses are arranged so as to focus all the light which passes the fibre, onto the lens in the side of the light-tight box. Within, on the cylinder, is a sensitive photograph film. Every change in the light is recorded by this, and thus the fibre's wanderings are recorded. This fibre is connected to the line, which connects it with the photo-telegraph sender, and every change in the current intensity, caused by the variations of the light on the selenium cell, is thus caught and recorded. Gradually the picture is printed out, bit by bit, and when fully exposed the film is developed, and the picture obtained.

Now the practical application of this idea to radio-telegraphy is a tremendous problem, yet Professor Korn has solved it, at least in part. As he could not hope, with any reasonable degree of success, to alter the actual power supplied to the radio-telegraphic transmitter, he has devised the scheme of

varying the actual current going out onto the aerial (i. e., varying the radiation). He engraves the picture by means of an insulating material, on a metal foil. This foil, with the engraving on it, is placed, picture side outwards, on a rotating cylinder; the foil is connected to the grounded side of the radio sender. The aerial side is connected to a sharp metal stylus or point, which is moved along the length of the cylinder the same as the lens described above moved. When this point rests on a section of the foil, covered by the insulating material, the full current of the sending set is radiated. When a place is reached where the insulation is thinner, some of the current passes thru here, and not into the aerial. When in close contact, the aerial is practically grounded and no radiation whatever takes place. In principle this constitutes the sending end, altho other difficulties are met with in practice.



A—Transformer
B—Aerial
C—Cylinder
D—Insulated Foil Carrying Picture
E—Stylus Point
F—Contact to Foil
G—Ground
H—Receiving Transf.
I—Resistance
J—String Galvanometer
K—Lenses
L—Cylinder
M—Reproduction of Photo

Wireless System

The receiving system has more resemblance to that used in the wire system. A standard radio-telegraph receiving set is used, with the usual aerial and ground, but in place of the wireless operator's head receivers, the string galvanometer is connected in the circuit. The variation in the strength of the received signals causes the fibre of the galvanometer to vary just as the variations in the wire system did. The resulting impressions on the film are afterwards developed and the picture obtained as before.

This system has not been perfected as yet, but some very promising experiments have been performed. Photographs have been sent from Berlin to Paris, a distance of about 500 miles, without any great difficulty. This certainly looks promising. It is at sea, however, where the greatest use for this invention will be found. For would it not be interesting, when many leagues from shore, to receive a paper containing the latest news of the day, and accompanied by illustrations taken at the scene of the action?

A more practical use of the idea, would be shown in the practicability of the transmission of the photograph of an escaped criminal, to all the vessels he would be likely to be aboard of, and thus make his identification much surer than by means of a simple wordy description. Another case would be the sending, for verification, of a man's signature, to be used in a forgery case, or the like.

Altho an experiment at the time of writing, it cannot be doubted that this device will be rapidly developed and its details perfected. The final result being, as are all great inventions, a lasting benefit to humanity.

D. B. McGown, '14.

Synthesis of Rubber

CHEMISTS, knowing the possibilities of producing products similar to natural compounds, have sought to build up a synthetical rubber.

Since the demand for rubber has increased and the supply of it decreased, early experiments by other men, led up to the successful experiments in obtaining the much looked for products, by Dr. W. H. Perkin in June, 1912.

Early investigators found the main constituents of rubber to be isoprene, an oily volatile hydrocarbon, obtainable from the oil of turpentine. The isoprene was experimented with, and under certain given conditions was converted to a substance resembling, very closely, caoutchouc. Starch can be changed into acetone or fusel oil by fermentation, and the resulting products can be readily changed into isoprene. A certain researcher found a germ capable of changing the starch, thus saving the cost of fermentation. A chemist stated that some isoprene was changed to rubber when brought in contact with metallic sodium. With all of this knowledge, Dr. Perkin experimented, and brought forth the statement that, without doubt, rubber could be obtained synthetically by treating isoprene and similar substances, and the product obtained was really rubber and could be compared with rubber.

Germany worked out a process along similar lines, and at a meeting of the Congress of Applied Chemistry in New York, September, 1912, the president of a certain factory in Germany showed two automobile tires made of his synthetic rubber that had been run over 4,000 miles. The German synthetic rubber withstood all the necessary tests and analyses. English rubber does not exactly tally in its chemical makeup or formula, with natural caoutchouc, and does not come up to all the necessary requirements. Much improvement will have to be made before the artificially made rubber can be placed on the market; but Dr. Perkin stated that it could be made at sixty cents a pound, while Para rubber brought one dollar and thirty-five cents. It was found later, that probably by the time the artificial rubber could be made cheaply, the output of natural rubber would be so great and so cheap that all the attempts would be useless, commercially.

A factory has been established at the mouth of the North Sea Canal, where synthetic rubber is made. The process used is secret, but it has been learned that fish is the main constituent. Fifteen per cent of natural rubber is added and the finished product is elastic and flexible and is very cheap. It may be vulcanized, is benzine-proof and resists heat considerably. As yet no ideal process has been discovered.

E. HOLMAN.

The Rontgen Rays

MOST wonderful of the many properties of electricity is the production, under certain conditions, of rays which can penetrate bodies which are perfectly opaque to sunlight.

These rays were first discovered about 1891 by Hertz, a German professor, and subsequently investigated to a limited degree by Professor Lenard of Bonn, but it remained for Professor Röntgen of the University of Würsburg to find that these rays could penetrate opaque substances and produce photographic effects on a sensitized screen behind the object.

To produce these rays a Crookes tube is employed. The tube is mounted on a stand by an adjustable clamp, the extension of the terminal tubes affording

a hold for the clamp. This enables it to be set at any required angle. The electrodes of the tube are connected with the poles of an induction coil capable of producing a spark four or five inches in length. A storage battery current is usually preferred to a dynamo.

The current being transmitted from the anode to the cathode produces light from each, the cathode rays being focused on the anode disk; and here the X-rays, which are invisible, are generated and projected at right angles to the axis of the tube from the forty-five degree slanting disk as a focal source through the glass on any object placed within their influence.

Another form of tube made with two platinum plates at the center, slanting in opposite directions, like the letter V, and two concave aluminum reflectors at the opposite ends, is also good. It is commonly known as the Geissler tube, and tho not so well known as the Crookes tube, is used almost universally. The Geissler tube was originally designed for use with the alternating current, the aluminum reflectors being used as the electrodes, the platinum plates being insulated, and the X-rays generated alternately on each of them as the polarity is reversed.

X-rays are transmissible thru all substances, solid, liquid and gaseous, but with different degrees of facility, dependent chiefly on the density of the object and, of course, on its thickness; dense metals, like platinum, lead and gold, tend to arrest and absorb them, while light metals, such as aluminum and tin, transmit them. To a less degree bone arrests the rays, while the other animal tissue transmits them. A curious example is glass, which tends to stop the passage of X-rays to a considerable degree, tho it is quite transparent to sunlight.

Certain substances become fluorescent when exposed to these rays, emitting light visible in a dark room. This is true of glass, barium platinocyanide, calcium tungstate, calcium sulphide, rock salt and uranium glass.

The shadows produced on photographic plates are called sciagraphs. Exposure of the plate, of course, is not permissible, as the picture taken would be a true photograph of the object, produced by reflected light, and not its shadow produced by the intercepted X-rays. Hence the plate must be enclosed during the operation in some substance opaque to light but transparent to the rays. This is done most conveniently by enclosing the plate in two or three thicknesses of black paper.

The negative is developed by the usual photographic process, and positive pictures are printed from it in which the light and shade are reversed, giving the true shadow picture.

The true nature of the rays is unknown, and no theory has been advanced which can be considered final. They can neither be refracted or reflected, and therefore cannot be focused either by a lens or a mirror. The cathode rays can be deflected from their course by a magnet, but magnetic influence produces no deflection in the true X-rays.

The practical uses of the Röntgen rays are many. The chief use is in surgery, showing the exact location of bullets, shot and other foreign substances without probing, and enabling their removal with less cutting and risk. Internal injuries, cavities and decay of bones are also shown very clearly.

Two views obtained at different angles are usually necessary to determine the exact location of the spot wanted. The commonest angle taken is ninety degrees.

It is known that X-rays produce a destructive effect upon animal tissue if subjected to its influence long enough; therefore, to protect the hands, gloves are worn when handling a machine.

The Röntgen rays are undoubtedly one of the greatest boons to suffering mankind that the world has ever known; but sooner or later, as our knowledge of the hidden forces expands, a mightier agent will ally itself with Science in its ceaseless struggle against Nature's destructive forces. P. Marks, '15.

The Gyroscope and the Monorail

THE properties of the scientific toy known as the gyroscope promise to effect some wonderful results in the practical world. Thus, the future of railroad transportation may disclose some such outcome as the sight of a train of incredibly large palace cars swinging along at a terrific rate of speed around curves and over straightaway stretches with the evenness of balance of a great bird, the whole onrushing mass being poised upon a single shining rail.

If this be a dream, it has at least some considerable foundation. It will readily be admitted that the crux of the whole matter is the maintenance of equilibrium upon a single rail. This difficulty, it would seem, has been successfully met by a British engineer, Mr. Louis Brennan, in his application of the gyroscope to railway service. Mr. Brennan mounts upon horizontal transverse axles two gyroscopes revolving in opposite directions at a high rate of speed. They are enclosed in casings from which the air has been practically exhausted. The whole arrangement is secured to the car. By means of numerous experiments and tests with a large-sized model, having a single row of wheels running upon a single rail, Mr. Brennan would appear to have completely demonstrated the success of his invention upon a small scale. This car maintains its balance upon an irregular piece of gas pipe, or upon a stretched cable. It descends grades, mounts inclines, rounds curves with ease and certainty—all with but one row of wheels upon one rail. Equilibrium is maintained whether the car is at rest or has a forward motion. The balancing apparatus totals about 5 per cent of the whole weight.

Mr. Brennan anticipates that it will be feasible to operate cars of the breadth of thirty feet. This would much more than realize the dream of certain authorities who propose the adoption upon the present-day style of railways of a track with a comparatively moderate increase of space between rails.

Mr. Brennan's proposition would appear to be a practical engineering possibility, while that of said authorities would not. This for the following reasons: It is, at present, a practical necessity to group wheels together in systems containing not less than four wheels whose relative positions are unalterably fixed. If a truck has a less number it can scarcely be relied on to remain on the tracks. This requirement of a unit of four relatively fixed wheels would not operate as a prohibition of the widening of the inter-rail space of our two-rail tracks, if there were no curves to round. When our present truck swings around a curve, the outer wheels have a greater distance to cover than the inner ones. This difficulty could probably be met by some arrangement having the outer or inner wheels rotate on their axles. But this is not the great and apparently unsurmountable difficulty. That consists in the fact that the curve requires that the two axles of the truck should now be no longer parallel, but should converge toward the center of curvature. With our necessarily parallel axles this cannot be done. And further, the greater the inner rail space, the more it is necessary to get away from parallelism. Consequently, the broader the tread of our trains the greater the friction at curves. Mr. Brennan meets this difficulty and solves it at one shake by reducing the tread to approximately nothing.

Many, no doubt, will say that perhaps an experimental car weighing 175 pounds may be entirely successful; and yet cars of standard size prove failures, thereby expressing that great weight would destroy the balance. Of course, this matter must come to an actual test. Mr. Brennan has dealt with this question of increased dimensions, and arrived at the conclusion that if the linear dimensions be increased two and a half times the ratio of the weight of the

gyroscope wheels to that of the car will not only not be increased, but will actually be decreased. In fact, he finds that the gyroscope weight percentage will be one-half the present rate.

Another great difficulty in present-day road construction is to lay the two rails so that they will accurately correspond in level and remain so. Mr. Brennan's system eliminates the matching one rail with the other.

The question that will arise in many minds is, what will happen if the power fails which maintains the gyroscope in rotation? Nothing will happen. At least not for a while. They will maintain sufficient speed to preserve equilibrium for several hours. But if the gyroscopes fail through some break? This is a catastrophe paralleled somewhat by breaks in our car wheels, axles, etc. The increased safety arising from want of significance of slight imperfections of track would perhaps more than compensate for this.

But not only on monorail cars is the gyroscope used, but also on shipboard for the prevention of seasickness, on aeroplanes to maintain their stability, and as a gyroscopic compass. To go into further details as to how the gyroscope is worked in the latter uses is not the purpose of this article. Yet this may be said: that in a few years to come the gyroscope, still, perhaps, a scientific toy, will be an article indispensable for the maintenance of the world's industries.

MAX AFTERGUT, '14.

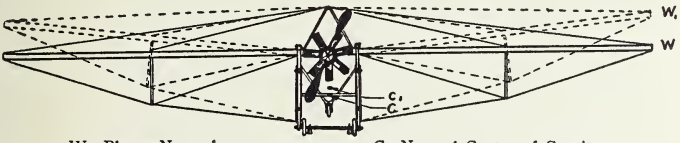
Automatic Stability in Aeronautics

AUTOMATIC stability is advantageous from some viewpoints and undesirable from others. One reason why it is advantageous is this: should the machine act automatically the aviator would not have to devote all of his spare time to driving. This is especially desirable in the army, as it would only require one man to drive and drop bombs.

On the contrary, however, some good authorities state that automatic stability is undesirable, as it does not give the aviator full control over his machine at all times. If the aeroplane is very stable it will tend to go in one direction, while the aviator may have to work in opposition with his machine if he desires to go in another direction.

The simplest means of securing automatic stability is by inclining the wings. (Fig. 1.) This lowers the center of gravity of the machine, making it less liable

FIG. 1.



W—Planes Normal
W_1—Planes in Raised Position
C—Normal Center of Gravity
C_1—Lowered Center of Gravity

While C_1 is actually higher than C, it is lower in relation to center of support, thus securing stability.

to overturn. The wings should not be inclined too much, or a side gust of wind will set the machine swinging like a pendulum. The Fokker aeroplane, of German make, uses this method of stabilizing and has had much success. A pilot navigated this plane for fifteen minutes, with hands and feet off the controlling wheel.

used successfully in the monorail car, it seems that is could be used to good advantage in aeroplanes. Mr. Glenn H. Curtiss is experimenting with this at San Diego and has had some success.

Another, and probably the most successful scheme for securing stability that has yet been tried, is by means of the pendulum method. This system consists of a pendulum, placed in the middle of the machine. When a side gust tilts the aeroplane, the pendulum swings back to the vertical. This operates the ailerons, or wingtips, and rights the machine.

Mr. Wright has been experimenting with this and has had unusual success. He succeeded, in a glider of his own design, in flying against the wind for one hour without a motor, the only supporting energy being the wind itself.

Automatic stability promises much. If it can be perfected, aeroplanes will probably become as safe and common as automobiles.

HARRY H. WICKERSHAM, '15

Pythagoras and His Treatment of the Right Triangle

PYTHAGORAS of Samos, the great founder of the Pythagorean school, was born on the island of Samos in 569 B. C. He was of Tyrian parents, and sprang from an obscure family into a place among the greatest mathematicians the world has ever known.

Of his early life little is known; in fact, the legends from which we gather the little that we do know, "is enveloped in a mystical haze" through which it is almost impossible to distinguish the historical from the mythical. However, it is quite probable that Pythagoras received his early training from Pherecydes of Syros, and later from Anaximander, both contemporaries of Thales. After having exhausted the resources of the Grecian archives he was unable to suppress his desire for further knowledge, and so he went to Egypt, on the advice of Anaximander, in search of further knowledge.

At Thebes and Memphis he remained many years studying with the Egyptian priests, whose confidence he succeeded in gaining. It took him some time to do this, though, as the Egyptians were very jealous of their learning and did not make a practice of sharing it with outsiders. The knowledge which he gathered in Egypt, combined with that which he had acquired in Greece, comprised practically everything that was known of mathematics in the civilized world. Having acquired everything he could from the then acknowledged sources of mathematics, he returned to Samos to enter into researches of his own. Here he also set up a school and gave lectures, but these were so badly attended that he gave up the school and removed to Sicily, in Magna Græcia.

At this point in his life he is so enveloped in the mist of legendary tales that we lose sight of him for the time being. We come upon him again in Croton, in Southern Italy, however, where he had re-established his schools and had become very influential. People flocked to hear his lectures, but his most important discoveries were confined to his own secret order of disciples, whose observances approach very closely to Masonic peculiarity.

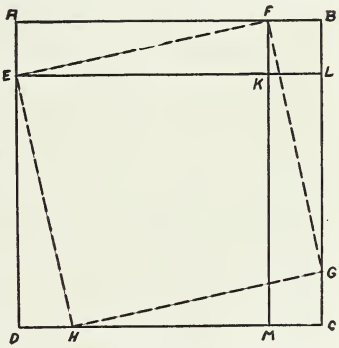
Because of its strong organization the order became very powerful politically, and for the next few years it practically ruled Croton. In acquiring his political strength Pythagoras made many enemies, whose bitterness constantly increased as he became more powerful. After many years of power and influence his enemies gained sufficient strength to storm and sack his buildings.

Pythagoras fled to Metapontum, where he was overtaken by the mob and murdered in 500 B. C. Even with their founder and leader dead, however, the disciples of Pythagoras kept up his school for over two hundred years, attributing all their discoveries to his name. So much for the man; now for his work.

The value of the Pythagorean school to the mathematical world can hardly be estimated. Many of the theorems and proofs which we find in the first two books of Euclid are said to be due to Pythagoras. But so remote is his age, and so secret the order in which he worked, that it is next to impossible to lay down the law and say, "This Pythagoras proved, and this is how he proved it."

This much we know, however, that Pythagoras, in his travels through Egypt, acquired the proof for the theorem that the square of the hypotenuse equals the sum of the squares of the other two sides of a right triangle in the special case, only, where the sides are three, four and five, respectively. This theorem was familiar to the Egyptians as far back as Ptolemy the Second, where we find evidences of its use in surveying and the determination of north and south.

It remained for the Pythagorean ingenuity, however, to generalize this theorem into covering the cases of every right triangle that could be conceived or constructed, and, although a great deal of discussion exists as to Pythagoras' exact method of proof for this theorem, the following is generally accepted as the one which he used, according to such authority as W. R. Ball, Allman, and Professor Gow:



Any square ABCD can be divided into two squares BK and KD and two equal rectangles AK and KC, which in turn may be divided into four equal triangles such as AFE, FEK, etc. Then lay off points G on BC, H on DC, E on AD so that BG, HC and ED are equal to AF. Then EHGF is a square on the hypotenuse of the triangle FEK and also the sum of the four triangles AEF, FGB, GHC and HED is equal to the two rectangles AK and KC. Then the square EFGH is equal to the sum of the two squares FBLK and EKMD, which in turn are the squares on the sides FK and EK of triangle EFK.

This is but one of the great fundamental principles which Pythagoras and his school gave to mathematics, not because of a lucrative compensation to be received, but because of their love of the truth and their insatiable desire for knowledge in its true and abstract form. Another of the great discoveries of Pythagoras was his treatment of irrational quantities. Pythagoras was a geometer through and through, and even his studies in irrationals may be traced to geometry through the isosceles triangle, whose two equal sides are both equal to one, and whose third side is, therefore, equal to the square root of two. After years of hard labor Pythagoras finally came to the conclusion that this expression had no solution, and that no figure could be constructed which would illustrate the irrational expression, the square root of two.

Pythagoras, therefore, named this expression an imaginary, which is on a par with all his other work, the tendency of which was to raise mathematics above the plane of commercial usage and to establish it as a science to be sought after by men whose minds are big enough and broad enough to allow them to soar above the earth and to see and comprehend the universe.

L. R. Wertheimer, '14.

Bessemer Steel

THE Bessemer process in steel manufacture, patented by Sir Henry Bessemer in 1856, was the first successful attempt to improve on the older methods of making both malleable iron and steel. Bessemer's original idea was to blow air through molten pigiron until practically the whole of the carbon was oxidized when malleable iron was required, and to stop the blast when a sufficient degree of decarturication was effected in order to produce steel.

By this process steel has been produced ranging from 1 per cent to 0.8 per cent carbon, the former being spring steel, and the latter a soft material replacing wrought iron. Rail steel usually contains 4 or 5 per cent carbon.

The various steps in the Bessemer process are as follows: Pig iron is melted either in a cupola or taken direct from the blast furnace, and run in the liquid state into a converting vessel. The converter, as it is called, is a steel shell lined with a silicious material called "ganister," and is suspended on trunnions, so as to admit of its being turned from an upright to a horizontal position by means of a hydraulic cylinder. The capacity of the converter varies from three to seventeen tons. In the bottom there are ten to sixteen tuyeres, each with seven to ten holes about one-half inch in diameter, through which air is blown with a pressure of from eighteen to twenty-five pounds per square inch by a blowing engine.

The molten iron is, therefore, resting on a bed of air, the strength of the blast keeping it from falling through the blastway. In ten or twenty minutes practically the whole of the carbon is removed. When the blow is finished the converter is lowered to a horizontal position and a definite amount of molten spiegeleisen, a kind of cast iron containing a large percentage of carbon and manganese, is added until it amounts to 5 or 10 per cent of the whole. The spiegeleisen restores the proper amount of clean carbon suitable for rails.

When it is desired to produce a soft steel similar in properties to wrought iron, instead of spiegeleisen, a small amount of ferro-manganese is added while pouring the steel into the ladle. There is a circular pit in front of every two converters, with a hydraulic piston in its center, and on its counterpoised arm a large ladle is hung so that it can sweep the whole circumference. Around this the ingot moulds are arranged, and the hydraulic machinery is so conveniently planned that simply by moving levers a man standing on a small platform can empty the contents of the huge converters into the ladle, raise or lower the ladle itself, and turn it around from point to point so as to fill the molds by means of the plug in its bottom. The moulds are taken from the ingots, which are then sent to the heating furnaces, where they are brought to an even and suitable heat. They are then rolled down in a blooming mill to smaller rectangular sections, which are known to the trade as blooms, billets and slabs. These in turn are again heated and rolled into rails, beams, rods, plates, etc.

The major portion of Bessemer steel produced since 1890 has been used for rails. The United States, Germany and Great Britain produced in 1902 fully 82 per cent of the total production of the world. The United States, with its great supplies of low phosphorous ores in the Lake Superior district, easily leads in the production of Bessemer steel by the acid process, while Germany, relying on the high phosphorus ores of Lorraine and Luxemburg, leads in the production of basic Bessemer steel.

F. Callsen, '14.

Editorials

THE TIGER

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From the Editorial Viewpoint

RECENTLY a committee from Lick visited various halls with the avowed intention of renting a suitable one for a social affair. At one hall the committee was informed that the club did not wish to rent their hall to any high schools because of certain unpleasant occurrences and the destruction of property caused by high school parties. Naturally the committee resented the inference, but very diplomatically held their peace until the person in charge of the rental asked the name of the high school which the committee represented. "Lick? Oh, well, that's different!" And the negotiations were soon under way.

Do you see the value of a spotless reputation, and the necessity for retaining it unblemished?

HAVE you ever stopped to consider the fact that we have social equality here at Lick? Did it ever occur to you that we have no cliques, no aristocracy, or any "better class"? Possibly you have noticed this—if you're from another high school you have certainly noticed that the snob element is lacking here. We are proud of these conditions, proud of our equality, and glad to meet every student on the same plane. "It is good to be here." Knowing the tendencies of human nature, you must have asked yourself, "Why is this true"? And can you answer the question? Why are there no snobs amongst us? There are certain fellows in every school who have more money to spend and who are better dressed than others, and it is often the case that the other students hold themselves aloof from such and actually create an aristocracy, after a fashion. But why doesn't this occur at Lick? Just consider the hours that we all spend in the foundry, in the pattern shops, in the forge and machine shop, each of us dressed in humble—nay, greasy—overalls and jumpers, all of us begrimed with honest sweat and dirt, our hands blistered and callous, and our brows moist with perspiration from hammering iron, shoveling sand or chipping steel. Could we resume caste after such a session? Could you dress after that and hold yourself a better man than your neighbor? For the creation of honest and patriotic Americans we could have no better training than that received in those melting-pots of equality—our shops.

THE school elections will soon be held, and the student body should be considering those possible candidates for offices. In the matter of election we should lay aside all matters of personal friendship with any particular candidates and vote with the earnest conviction that we are selecting the ablest and most fit person for the office in question. The party system adopted last year was a very successful means of bringing the candidates into the limelight, and—the Faculty permitting—the TIGER wishes to advocate the repetition of last year's campaign system.

FOR several years past it has been the custom to dedicate the March issue of the TIGER as a Baseball Issue. Owing to the fact that the ball season is not far advanced and no games of great importance have been played, we have decided this year to eliminate the Baseball Issue. Notwithstanding this fact, our best wishes for a successful season are directed to the team. This, as well as any other student activity, is worthy of the undivided support of the Student Body. Back the ball team as you did the Rugby team and we shall see our conquering heroes marching home to be decorated with their merited block "L's" and possibly—tho this is a mere conjecture—they will be asked to jump the local league and join the Federals. Who knows?

THIS is our last opportunity to plead for your support and for a worthy cause—the Senior farce. For years past it has been the custom for the Senior class to raise funds to defray the expenses of the Senior ball by holding a farce either in some outside theater or in a hall, in conjunction with dancing. This year the class has decided to co-operate with the Lux Senior class and give a three-act play, or farce, to be followed by an informal dance. The committee is at present seeking a suitable farce, and promises to produce something exceedingly fine. Considering the talent evidenced by those members of the class who participated in the Debating Society farce, we predict a brilliant and praiseworthy production, and once more we ask the support of the student body.

SOMETHING new in the shape of literary societies is promised us, and before this book leaves the press a new society for the purpose of studying and encouraging short-story writing will have been formed. All members of Lick, Wilmerding and Lux student bodies are cordially invited to the meetings, which will be held on alternate Friday afternoons, commencing February 20, 1914, in the living room at Lux. The society will certainly fill a long-felt want, and should do much to improve the writing of all those who attend and apply the knowledge gained. The training which students in such technical schools as ours receive in writing is necessarily abbreviated, and consequently the short-story club will be of great assistance to those of us who are literarily inclined.

IN THE next issue—the commencement number of the TIGER—we shall have the co-operation of the Lux staff. Since the divorce of the Lick and Lux student bodies, the TIGER has lacked any of the feminine contributions which formerly graced its pages. Now we shall once more feel the presence of a feminine hand, and the TIGER is overjoyed at the prospects of the feminine caress. Miss Hogan, Editor of the *Lux,* will assume the editorial responsibility of the *Lux* contributions, and supervise the arrangement of the *Lux* material. The matter has been thus arranged because of *Lux's* financial disability to publish a journal unassisted, consequently the entire support of the combined student bodies is earnestly solicited.

VOTES FOR WOMEN

SCHOOL NOTES

Camera Club Exhibition and Tea

One fine afternoon everybody sauntered up to Lux and was received with open arms by a committee from the L. W. L. Camera Club. They were escorted around the building together with many fond mothers who had come to view the works of these wizards of the darkroom. They were surprised and delighted to have a chance to view the Faculty "as it was in days gone by." The exhibition was complete, interesting and beautiful, and many thanks cannot express the appreciation of the magnificent loan exhibits.

Then a dear little maid in cap and apron escorted them to the living room, where Miss Miller presided over the tea table, and was assisted by many fair waitresses in dispensing that liquid refreshment which cheers but not inebriates.

When they departed every one vowed that never had he spent a more enjoyable afternoon.

The Rallies

Since the beginning of the year school spirit has taken a great boost. The rallies have been well attended, especially when the girls visit us.

The rallies have been held to advertise the basket-ball games, and as a result, over half the school was at the final game.

The orchestra always helps to liven things up, and much credit is owing them for the spirit of the gatherings.

The principal rally was a joint affair, advertising the L. W. L. D. S. farce and dance. Waterman and Wertheimer displayed histrionic talent. The spirit aroused was largely responsible for the success of the evening.

German Library

In the past the need of some German books has been decidedly apparent. Max Aftergut, a student recently from Germany, has supplied us amply.

The collection he has lent the school consists of over a hundred volumes—scientific works, novels, albums and bound magazines. Among the volumes are:

Name of Work	*Vol.*	*Name of Work*	*Vol.*
Huder's Werke	5	Lessing's Werke	3
Heine's Werke	4	Rueckert's Werke	2
Shakespeare's Werke	4	Goethe's Werke	1

The L. W. L. D. S. Show

A good example of the work that is being done by the union of Lux, Wilmerding and Lick was shown in the affair given by the L. W. L. D. S. on the evening of January 30, 1914, at the Sorosis Hall. An enjoyable farce entitled "My Lord in Livery" was given, in which our young Thespians, who had been trained under the critical eyes of Miss Coffin and Miss Denny, gave a fine exhibition of amateur acting. The cast was composed of Miss Lightbody, Miss Hogan, Miss Marcy, and Messrs. Trauner, Hess, Johnson and Hass. Following the farce the evening was given over to dancing.

Too much cannot be said in praise of the work of President Hardy's organization, and too many thanks cannot be given to those who worked hardest for its success, Miss Coffin and Miss Denny.

Mechanical Drawing

Since this department was moved from the shop building the members of the A. O. P. S. and the Junior apprentices have necessarily been busy. There has been quite a little acting on the stage.

The Seniors are all working earnestly. A. L. Johnson is now designing a fifty-foot bridge, having finished some coke bunkers for our foundry. Bowes finished a Scotch marine boiler, and is now designing a propeller. Bates and Marks have both finished testing machines. Holmes finished a thirty horsepower marine engine, and is now drawing a five horsepower Diesel engine. McAbee is working on a thirty horsepower marine engine. Pupinbrink has finished drawing a high-pressure reducing valve. Webster finished a sixty-ton pipe vise for Mr. McLaren, and is now drawing a seventy horsepower Pelton water turbine.

The Juniors are all either on standard sheets or tracing Senior drawings. The Sophomores are finishing up the sheet on the intersection of a cone and cylinder.

Pattern Shop

Sheldon Barz and Moiesant are working on a two-cylinder air compressor. Maynard and Gerard are also helping on this, which will be ready for the next casting.

Le Gal made an excellent pattern for a vaporizer. Other patterns that are being made are a centrifugal pump and a pipe-cutting machine which Hansen and Grimm are making.

The boys that are not working on any of these patterns are making hand wheels, pulley wheels, or bushings. The work done is exceedingly good, and if kept up will set a record.

Chemistry

Langlois and Kolb, the Senior apprentices in this department, are at present working on the analyses of iron and steel, having finished their water analysis.

The Juniors are finishing volumetric analyses, and are going to start the anaylses of iron ores.

The Sophomores have been to the Stauffer Chemical Works, and are continuing their experiments.

Foundry

Among the great number of moulds that are in the foundry there are the parts for another steam hoist, two gas engine cylinders, a bed plate for a speed lathe, a small punch and shear machine, and a vacuum cylinder for a vacuum cleaning machine.

Some of the other parts that are to be cast are fly wheels, pulley wheels and a dozen vises for the pattern shop.

Basketball

Although it did not fall to the lot of the 1914 Basket-ball Team to win the championship, we can look back on the season without regret, knowing that we met defeat in a true Lick spirit, fighting until the last, and that superior merit, and that alone, spelled our defeat. It was a fighting team that wore the Black and Gold this season, and to them we extend our sincere thanks for the fight they put into the game for Lick.

On the evening of January 9th, at the Rice Institute, the team, after a hard practice season under Captain Asher, entered their first league game of the season against the St. Ignatius five. Confidence was everywhere evident in the Lick section, and the final result of the game, in which Lick met defeat, was a severe blow to the Lick rooters. The final score stood 17 to 15 in favor of the St. Ignatius Team.

Lick made an auspicious start by scoring several points soon after the opening of the game, and the spirits of the Lick rooters soared. At the end of the first half we led by a margin which appeared substantial, and even the most pessimistic of the rooters from school were hopeful.

The tale of the second half is one of hard luck from the Lick standpoint. We seemed to be playing in the hardest of luck, and the team appeared to lose that confidence and dash evidenced in the first half. Soon the St. Ignatius five had forged to within two points of us, and when the final whistle sounded they had passed us by two points, giving the initial game of the season to the Ignatian five. From the rooters' standpoint, aside from the game itself, there was plenty of excitement. The Ignation supporters were none too friendly, and little love was wasted on the Lick section. At one time a melee appeared inevitable when one of the St. Ignatius players swung on Captain Asher, causing the ejection of both players from the game. It looked like a frameup, and many of the neutral spectators at the game stated that there was little grounds to justify the referee's ejection of Asher.

Smarting under the loss of the St. Ignatius game, the team, on January 27th, decisively defeated our neighbors at Wilmerding by the score of 49 to 27.

The playing of the team showed a marked improvement over the St. Ignatius game, and they took the lead right from the start, not to be headed until they had buried Wilmerding far beneath a 49 to 27 score. The goal-shooting of Captain Asher was a big factor in the Lick victory.

Mission High School fell an easy prey to the chosen five from this school, and the score of 68 to 14 tells the tale of the one-sided game that it was. At no time did Mission have a chance to even threaten our chances for victory. The guards played shutout ball, while the playing of the forwards and center kept a steady procession to the Mission goal. Asher and Schwarzenbek were

the heaviest scorers of the team. Although Mission lost, it cannot be said they did not fight, and it was only the team work and superior speed of our five that gave us the game.

Destined to again play in hard luck, the team entered the game on the evening of February 4th against our old rivals from Lowell. The old rivalry that has long characterized a Lick-Lowell game was evident, and there was not a Lick fan present but would have been willing to make almost any sacrifice that the team might win. This, however, was not to be our lot, and, after one of the hardest-fighting games of the season, the team acknowledged the superiority of Lowell by the score of 39 to 15. The weight of the Lowell team was a big handicap to our team, and this, coupled with a bad attack of stage fright, due to the importance of the contest, spelled the final outcome in favor of Lowell.

During the league season different lineups have been used. Asher has played between guard, forward and center, while the remainder of the squad has been equally as much shifted. Hulling and Schwarzenbek played at forward almost the entire time, and the playing of these two athletes was of the first order. At center Asher played his usually brilliant game of last season, with an improved defense. Gaustad, Madden and Wolongiewicz also alternated at center. At guard, Pengelly, Greene, Feldcamp and Lewicke alternated. The playing of all these four has been fast, and there was little room for improvement.

Baseball

With but two veterans of last year's ball nine—Deane and McAbee—with which to commence the season, prospects at the opening of school appeared none too bright for a championship Lick Team this spring. By the failure of Glen Laughlin, captain-elect, to return to school, the season was opened without even a guiding skipper, and for many seasons past the outlook at the opening of school was never more discouraging.

All is changed now, however. Deane, acting in the capacity of manager, held practice for two weeks, working the squad into shape, and as a reward he was elected to the position of captain of this year's nine. The largest turnout in years answered Deane's call for candidates, and the outlook has changed from a discouraging to a promising looking season.

To date the team has engaged in four games and has shown in these contests that the student body can well place its confidence in the final nine to uphold the name of Lick. On the whole, the playing has been much better than expected. McAbee, last year's twirler, is showing even better form than last year, and, with Norman as a relief pitcher, the mound staff appears to be adequate. Deane will hold down third base, from where he can direct the team, while the remainder of the positions, both in the infield and outfield, are as yet undecided.

The game of the most importance scheduled for the next few weeks is our annual contest with the Lowell High nine Saturday morning, the 21st. Last year we suffered a defeat from our rivals, and the hope of the ball team is to avenge the defeat of last year with an overwhelming victory over Lowell. Manager Weyl has it all figured out that we just can't lose, and as "Fat" knows, it seems probable that we will bring home Lowell's hopes to be buried again on the "campus."

Swimming

The swimming prospects for the spring season are particularly promising. All indications tend toward Lick's having notable success in this line. Captain Smith is working conscientiously to round up the candidates into satisfactory condition. Of the aspirants for honors, Merrill is the most promising. He has excellent chances of capturing the half mile. With Lasky and Fox in the quarter, Smith in the two-twenty, and Bates and Hulling in the sprints, Lick has a well-balanced and formidable aggregation of swimmers.

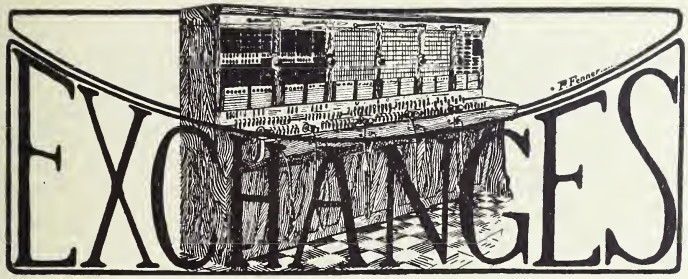
The semi-annual interclass has been scheduled for March 18. With the big team men entered, a series of closely-contested races are assured, and numerous school records will undoubtedly be smashed.

Track

With the coming of spring track athletics have received a new impetus. Prospects are brighter than they have been for the past few seasons. Captain Wolongiewicz has been training conscientiously, and promises to add a few more laurels to the school's record. He will be the mainstay in the high jump and hurdles. Dewing can be seen any afternoon soaring over the bar, and promises to figure strongly in the pole vault. Easton, a new man, is also showing good form, vaulting with Dewing. Hitzeroth and Fenner also are expected to show up good in the sprints.

Cross-country tryouts were held Wednesday, February 11, 1914. The aspirants went over a very difficult course of about three and three-quarter miles. Pengelly finished first, Banfield, Lewicke, McCartney, Gordon, Hardy, McWilliams and Cody finishing closely behind. The first five will represent Lick in the A. A. L. cross-country run on Saturday, February 21, 1914. Captain Bowes unfortunately will not be able to compete for a few months owing to an injury. He would have been one of the strongest contenders.

Track interclass will be held at Jackson Park, Wednesday, February 25, 1914. The A. A. L. will be held on April 4, 1914; the Stanford interscholastic, April 11, 1914, and the California interscholastic, April 25, 1914.



The quarter has again rolled around and the exchanges are once more piled, a couple of feet high, on the desk. The Exchange Editor looks them over as though looking at old friends. Of course, some have new covers on, and maybe even the contents have changed somewhat. Yet, in all, there is the same spirit that seems to flow through the veins of every issue, no matter how changed the subject matter. Each book is a missionary speeding on its journey to schools far and near, working for a better understanding and sympathy between otherwise totally unconnected student bodies. Each awakens a feeling of kindredship in the body of the recipient and makes possible the formation of a kindly and indulgent, though nevertheless judicious and critical, opinion on the merits and demerits of the paper, and even of the school, as a whole. Because of this it is always hard to say anything that sounds like harsh criticism. But criticise we must. However, not as a total stranger, but as a sympathetic and kindly friend, who would help his comrade to reach a higher plane of perfection, are these words written.

One of our old friends that is always on time with a wholesome amount of good, snappy reading matter is the *Mountaineer,* Butte, Montana. The issue is dedicated as an Alumni one, and the plan for the formation of an Alumni Association is worthy of much praise. The story of Butte High School, as it was thirty years ago, is a delightful reminiscence that tends toward the formation of a unified spirit between the graduates and the undergraduates. The departments, especially the class notes, are ideally written, and exchanges are very originally treated, though a little longer criticism of each would probably be better.

Though not so large and pretentious as some of our exchanges, *Whims,* Seattle, Wash., is about as finely gotten up and well finished a paper as we have seen. The book is called an Indian number, and the whole publication, from the cover design down to the last joke, reflects the Indian. All the pages are decorated with little sketches of Indian subjects. The story on the "Umatillas at Pendleton" is a fine one, and nicely illustrated by appropriate half-tones. The class notes, which, by the way, are called "Our Tribes," are well prepared. The rest of the departments, each with an appropriate title, such as the "War Path" for athletics, etc., all tend toward the forming of a harmonious whole that would be hard to improve upon.

After hunting up in our Spanish dictionary, or, rather, asking a good linguist who happened to be standing near, the meaning of *Olla Podrida,* we were in a mood to enjoy it. This awe-inspiring name is the title of the publication put out by the Berkeley High School, and the paper fully lives up to its title. It is a breezy, interesting resumé of all the activities of the past six months, interspersed with lively, amusing photographs and forming on the whole an ideal publication of its kind. The interviews with prominent characters are very fine and worthy of a place in the main body of the paper. Though one might trans-

late *Olla Podrida* into English as "hash," it really surpasses that staple article of the boarding house, or at least of the boarding house humorist, not only in the diversity of its contents, but also in its wholesomeness and excellence.

The story we liked best in the *Owl,* Fresno, Cal., was "Sam's Valentines." Though the other stories were all good, we liked best the suggestive method of relating the above little story. The cartoon work and cuts are very well executed, and the jokes are better than your cartoonist seems to think. On the whole, the *Owl* is more than maintaining the high standard set up in former years.

One of the best arranged and finest finished books we have ever received is the *Wild Cat,* Los Gatos, Cal. The cover is simple, but very appropriate and pretty, and the whole paper has an air of dignity and good taste. As far as general arrangement and tastefulness in makeup goes, the *Wild Cat* is perfect. This perfection is also shown in the reading matter. Among such an array of fine stories it is hard to select any particular one as the best, but it is sufficient to say that they are all excellent.

The cover of *Ye Searchlight,* San Rafael, Cal., gave a fine first impression of the paper and promised well for the rest of the publication, which promise was admirably fulfilled. *Ye Searchlight* probably devotes a larger proportion of its space to literary work than any other paper we have seen, and every story is fine. Unlike some of its cotemporaries, *Ye Searchlight* offers a wide variety of all kinds of literature from a melancholy article like "Under the Desert Stars" to a very highly-colored and ultra-modern story like "Dear." In our opinion, "Dear" is one of the best stories in any we have noticed among our exchanges.

A heavy-set, masculine appearing book is *Keramos,* East Liverpool, Ohio. There is a certain solidity and individualism about it that stamps *Keramos* out as being distinctive. Maybe the January issue is not so good as ordinary, but we were sorry to see that this praiseworthy distinctiveness was not equally well shown in the literary work. In fact, the stories were decidedly commonplace, and not nearly up to the standard of the rest of the paper. However, this was partially made up for by the excellence of the Exchange, Athletics, and other departments. Bring up the literary work to the plane of the paper as a whole, and this paper will be pretty near perfection.

After three years of silence the *Orestimba,* Newman, Cal., returns to life. For such an inexperienced staff, the result is really an agreeable surprise. There is no need for the excuses published in the Editorial column, as the *Orestimba* is a book that a student body of much larger enrollment than sixty could well be proud of. The cover is exceptionally neat and pleasing, and the linen paper of the interior is a decided improvement over any stock we have seen used in our other cotemporaries. "A Union of Colleges" is a tasty little morsel, and shows good ability. "When Talent Is Rightly Placed" is also an interesting story. On the whole, *Orestimba* is an excellent publication, and we hope to see it appearing regularly.

Probably the most forceful and reliable editorial we have had the pleasure of appreciating is that of the *Manzanita,* Watsonville, Cal. It is to be deplored that there should be a necessity for such a powerful dissertation, but when it becomes necessary to drive a point home, it is always best that it be done in the strongest manner possible. Surely an editorial of such power will work much good. In "Sam Lee" the author has tackeled a difficult subject, but has worked it out admirably. It has a genuine human interest and sympathy in it, and, though the shortest, it is probably the best story in the issue. "The Quest of the Cake" is an entertaining story and helps balance the seriousness of the other stories. "A Phase of High School Relationships" is a fine essay, and "King Arthur's Isle" shows much originality and imagination.

As usual, *The Echo*, Santa Rosa, Cal., has issued a Christmas issue that not only surpasses the preceding issues, but is without a fault. The cover is fine and printed on appropriate stock. The art work is of a very high order and adds greatly to the value of the paper. "The Questioned Power" is written on a subject not often attempted by a high school pupil and has a fine touch of sympathy. While reading "The Fortune of Misfortune," one accumulates a bit of knowledge of Hawaiian birds, etc., and at the same time enjoys a good story.

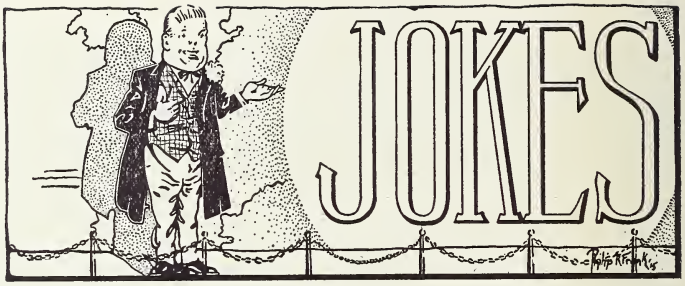
The *El Gabilan,* Salinas City, Cal., blossoms forth as a semi-annual instead of a quarterly and a decided improvement is noted throughout. From the neat, artistic cover to the last joke the paper shows painstaking care and hard work. The quantity and quality of the poetry is superior to that in any of our exchanges, barring none. Out of the numerous pages of the wooing of the Muses we find it impossible to say that any particular poem is better than the rest. Of the more serious odes, "Holly" and "The Flood" are excellent, especially the skill in the use of dialect shown in the latter. "About Writing Poetry" is about the best of the poems written in a lighter vein. "Swimming" is an amusing episode and is interestingly written. "Mince Pie Argument" has some very beautiful descriptions. All the rest of the literary work shows an unusually high standard of excellence. The departments are all well written, and taken altogether, it is the best issue Salinas High has ever turned out and one of the best on our list.

The *High School Recorder,* Brooklyn, N. Y., is crammed from cover to cover with news—real news. So many of our exchanges pay so little attention to making their papers a complete record that it is a pleasure to pick up a book that not only calls itself a recorder, but sets out to live up to this title. Pages are devoted to athletics, societies, etc., which is what a high school paper should do, but at the same time the literary department is by no means slighted. Quite the contrary. "School Spirit" is a fine, long, interestingly-written story, and shows much dramatic force. "B. H. S. in the Canadian Rockies" is a finely-prepared article, and the half-tones add greatly to the value of the story. In brief, the *Recorder* has only one slight fault, and it is one that can easily be remedied, if such an improvement is thought expedient. The fault is the lack of a good joke and cartoon section.

The Cogswell, San Francisco, has proved for the benefit of all doubters that there is no truth in the saying that a technical school cannot turn out good literary work. The stories in the Christmas issue need take second place to none, not even of the best academic high schools in the country. "Amateur Actresses" is an intensely interesting story, while "Practical Experience" shows great ability. It is not only much longer than any in our other exchanges, but it sustains the interest to the end—a point that is often missed by the amateur writer. The addition of a Manager's Page is a good plan, and, like all the departments, is capably written. We have but one suggestion for improvement to offer; that is, the editorials should be more forceful.

Among the high school papers that are printed by the students themselves is the *Item,* Pasadena, Cal. We cannot decide which is worthy of the more praise—the material in the book or the actual setting up of the said material by the young Benjamin Franklins. Without doubt, however, each is about as good as any work of its class in the State. The art work is exceptionally well executed, and the departments "Science" and "Who's Who" are uncommon ones and worthy of commendation. "Navisoma" is a story of much dramatic power, and the two sketches illustrating it are a decided novelty. Taken all in all, the *Item* is a book that speaks volumes for the effort and painstaking care of the whole staff, and is a book that any school would be proud of.

Space prohibits the criticism of seventy-three other exchanges, which we have received since our last issue. However, we have mailed an acknowledgment card to each, bearing a brief criticism.



Obedient Mac.

Mac was struggling through his English lesson.

"No, said the Captain," he read, "it was not a sloop. It was a larger vessel. By the rig I judged her to be a—a—a—

The word was new to him.

"Barque," supplied the teacher.

Still Mac hesitated.

"Barque!" repeated the teacher—this time sharply.

Mac looked as though he had not heard right. Then, with an apprehensive glance around the class, he shouted:

"Bow-wow!"

Business Reason.

An old colored man, charged with stealing chickens, was arraigned in court and was incriminating himself when the Judge said:

"You ought to have a lawyer. Where's your lawyer?"

"Ah ain't got no lawyer, Jedge," said the old man.

"Very well, then," said His Honor, "I'll assign a lawyer to defend you."

"Oh no, suh; no, suh! Please doan do dat!" the darky begged.

"Why not?" asked the Judge. "It won't cost you anything. Why don't you want a lawyer to defend you?"

"Well, Jedge, ah'll tell you, suh," said the old man, waving his tattered old hat confidentially. "Hit's jest dis way, Jedge—ah wan' tuh enjoy dem chickens mahse'f!"

Rebuke.

"Wert" was sneeringly watching Weyl eating peanuts.

"Down where I came from we use peanuts to fatten hogs," he remarked, casually.

"That so?" asked little Weyl. "Here, have some."

Complimentary.

Jack—I was just admiring Mabel's hair. How pretty it is.

Mabel's Rival—Oh, she has some prettier than that.—Ex.

Who Put This in the Joke Box?

Nixon—Have they named any new pie "Aristotle" yet?

Bisset—No. But I heard Ransdall ask for a Plato soup.

A Little Bull.

"Ah, your language! Eet is so difficult."
"What's the matter, Count?"
"First, zis novel say ze man was unhorsed."
"Yes?"
"Zen it say he was cowed."

Almost Guessed It.

Grown-up (looking at corners of little girl's mouth)—I know what you had for lunch.
Little Girl—What did I have?
Grown-up—Egg.
Little Girl—No, I didn't. I had 'em for breakfast.

Ladylike.

"Frances," said the little girl's mother, who was entertaining visitors, "you came down stairs so noisily that you could be heard all over the house. Now go back and come down properly."
Frances retired and in a few moments re-entered the parlor.
"Did you hear me come down that time, Mama?"
"No, my dear, that time you came down like a lady."
"Yes, Mama," explained the child, "I slid down the bannisters."—N. Y. Globe.

Local Color.

Mose Johnsing—Monday night I was in de arms of despair, Tuesday night I was in de arms of Morpheus, Wednesday night in de arms of de Lord.—— Sister Jackson, hab yo' an engagement for to-morrow night?—Ex.

Can You Beat It?

The scrubs were told to write a composition in honor of Washington's Birthday. One little boy handed in a drama, as follows:
Act I—The Lieutenant was walking down the street and he sees the Captain and says, "Gee, Cap., ain't it fierce we ain't got no American flag?"
Act II—The Captain was walking down the street and he sees Gen. Washington and he says, "Gee, General, ain't it fierce we ain't got no American flag?"
Act III—Gen. Washington was walking down the street and he sees Betsy Ross and he says, "Gee, Betsy, ain't it fierce we ain't got no American flag?"
And Betsy says, "Here, hold the baby a minute and I'll make you one."—Ex.

A Modern Usage.

Drug Clerk—Did you kill any moths with those moth balls I gave you?
Disconsolate Customer—No. I tried for five hours but I couldn't hit a one.—Columbia Jester.

Pessimist!

"This towel is disgraceful," declared the drummer at the mining camp hotel.
"Boss," said the colored porter, "seventy-five men done wiped dey han's on dat towel dis mawnin', an' you is de first to complain!"—Denver News.

Hargrave—Can you imagine why I call my dog Hickory?
Hogue—No. Why?
Hargrave—Because he has such a rough bark.

Hiene (just returning from Egypt)—Oh the pyramids were wonderful, and just covered with hieroglyphics.
Mauk—Gee Wilikens! Did you get any of them on you?

Heyneman—I had a fall last night which rendered me unconscious for several hours.
Osgood—Gee! That's hard luck. Where did you fall?
Heyneman—I fell asleep.

Pastoral Meditations.

The naked hills lie wanton in the breeze,
The fields are nude, the groves unfrocked,
Bare are the quivering limbs of shameless trees,
What wonder is it that the corn is shocked?—Pelican.

When Andy Was Six.

"Why, Andy, I do believe you're teaching that parrot to swear."
"No, I'm not, mother," Andy replied, "I'm just telling it what it needn't say."

An Everyday Tragedy.

Mary dropped her eyes to the floor as Henry burst into the room. Her face lengthened rapidly, and she finally pierced him with a glance. As his laugh rose and fell, she dropped her jaw and her voice broke.—Ex.

Walker (Daily)—Say, Bowes, lend me a car ticket.
Bowes—Can't do it.
Walker—Why?
Bowes—They have to have company.
Walker—What do you mean?
Bowes (harshly)—They can't bear to be a loan.

Mr. Rundall—What tax caused the recent rise in beef?
Whisper—Thumb tax.

Mr. Plumb—Why are iron wires used on telegraph lines?
Duncan—So that you can have a pole at each end.

Oily to bed and oily to rise
Is the fate of man when an auto he buys.—Ex.

Miss Denny—Characterize the works of Swift.
Hardy—"Some speed!"

Hess—Which is right, a reservoir or au revoir?
Schiek—Au revoir."
Hess—Tanks.

Osgood—Wood does not conduct heat.
I. Frank—Oh, no wonder he is so cool-headed!

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Without Due Thought.

Wifie—Which is your favorite club, dear?
He (absently)—The ace.—Ohio Sun-Dial.

How Kind of Father.

"When your father told you to leave for London on the next steamer, did it make you happy?"
"No, it made me cross."—Harvard Lampoon.

Mother Knows Her Boy.

"Jenny, go find Johnny; see what he is doing, and tell him to stop it right away."—Life.

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Boozy Bounder—Zash all right, m' boy—put on more speed—hic—and we'll catch it yet!

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Father (to Grad.)—I want you to stop this infernal borrowing and go into business for yourself.

Grad.—All right, Pop, if you'll lend me the money to start on.—Pennsylvania Punch Bowl.

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  Rather green;
Balky fire,
  Gasoline.
Pours the fluid;
  Travels far.
Floral token—
  "Gates Ajar."—Ex.

Some Headwork!

A letter was received in a post office bearing the following inscription:

Wood
John
Mass.

The authorities were puzzled, but at last someone figured it out, and it was sent to John Underwood, Andover, Mass., who proved to be the one for whom it was intended.—Ex.

I Wonder!

Miss Denny—Who wrote Gray's "Elegy?"
McGown (after deep thought)—I can't remember.

Four Years in the Language of Shakespeare.

Freshman—"Comedy of Errors."
Sophomore—"Much Ado About Nothing."
Junior—"As You Like It."
Senior—"All's Well That Ends Well."—Ex.

Latest School Yell.

Hobble, hobble! trip, trip! swish! bing! ah!
Oh thou hobble skirt, getting on a car!
Rip, rip! split, tear! stepped too far!
Hobble skirt, hobble skirt, siss, boom, ah!—Anon.

More Day Dreams!

Mr. Plumb (in Physics)—Webster, what is force?
Little Phil (licking his chops)—Breakfast food.—Ex.

Can You Blame Him?

Two well educated negroes were having an argument about famous paintings, when suddenly one drew a large black cloth from his pocket. "Here, Sambo," he said, "is one of the most famous paintings of the age."

"Yes?" answered Johnson, "I don't see anything!"

"Well," answered Sambo, "that's because you can't appreciate it. This painting represents two colored gentlemen having a fight in a tunnel."

(Sambo arose with a lame leg.)

To the Point.

Hitzeroth—Do you serve lobsters?
Waiter (politely)—Yes, sir, we serve everyone; sit right down.—Ex.

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The Daughter—Shoot the juice!
The Father—Cut out that slang, please!
The Mother—That's a peach of a way to correct the kid!
The Father—I only want to put her wise. Such talk will queer her.
The Daughter—Ishgebibble!—Punch Bowl.

Just Like a Scrub.

English Teacher—What made Vulcan lame?
Freshman—Why, he slipped on a thunder peal.—Ex.

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"See that fellow that just went by? He landed in the city with bare feet and now he's got a million."

"Great Jupiter! That beats the centipede all hollow!"—Ex.

In Civics.

Mr. Rundall—Deane, name one other court?

Deane—Court plaster.

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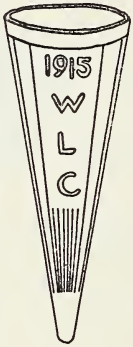

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Johnson—What! Say, do I look green?
Trauner (dryly)—Yes, Jaehne got up at 6 and Gusie got up at 7.

Bloodthirsty.

Miss Denny—We'll take the lives of Bacon and Shakespeare to-morrow, so come prepared.

The Nearest Yet.

Bowes—Has perpetual motion ever been discovered, Mr. Plumb?
Mr. P.—Well, there's the Mexican Revolution.

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A Suggestion for Civics.

Enthusiasm in a class room
  Works like yeast cakes in the dough;
Each depends upon the other
  If you want to make things go.

Dough would always be too heavy
  If you left it to itself,
And the yeast cake, too, is useless
  When upon the pantry shelf.

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When you mix the two together,
  Zip! The stuff begins to grow;
There is life and zeal about it,
  Soon its work begins to show.

Any class may sit and sour
  Like a batch of heavy bread,
With enthusiasm lacking
  And the energy all dead.

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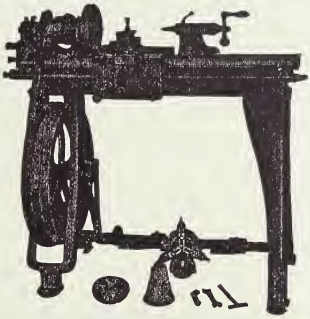

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Make the rest around you smile;
They will grow enthusiastic
If you only start the style.—Ex.

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TANGOING

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Both must be correct and up-to-date.
Neither can dispense with a *"two em brace."*

NOTE: Those who do not catch the point, and those who, having caught it, appreciate it, are invited to call on

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